MA1404	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		4	0	0	4

OBJECTIVES :

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	TESTING OF HYPOTHESIS	12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean, and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT II	DESIGN OF EXPERIMENTS AND STATISTICAL QUALITY CONTROL	12

One way and two way classifications - Completely randomized design - Randomized block design - Latin square design - 2^2 factorial design-Control charts for measurements (X and R charts) – Control charts for attributes (p and c charts).

UNIT III	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	12

Solution of algebraic and transcendental equations - Fixed point iteration method -Bisection- Regula -Falsi Method-Newton Raphson method - Solution of linear system of equations - Gauss elimination method - Pivoting - Gauss Jordan method -Secant method- Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	12

Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Approximation of derivates using interpolation polynomials - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules and 3/8 rules-Romberg's Method - Two point and three point Gaussian quadrature formulae.

UNIT V	NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS	12

Single step methods : Taylor's series method - Euler's method - Modified Euler's method - Fourth order

Runge-Kutta method for solving first order equations - Multi step methods : Milne's and Adams - Bash forth predictor corrector methods for solving first order equations-Finite difference methods for solving second order equations - Finite difference solution of one dimensional heat equation by explicit and implicit methods.

	TOTAL :	**60**	**PERIODS**

OUTCOMES :

Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of in the field of statistical quality control.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications

TEXT BOOKS :

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science", 10 th Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8 th Edition, 2015.

REFERENCES :

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9 th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8 th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8 th Edition, Pearson Education, Asia, 2007.

ME1401	**MANUFACTURING PROCESSES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To attain exposure on computerized numerical machine tools and micromachining processes
- To learn about the various non-traditional machining processes, their working principles and material removal mechanisms
- To understand about the high speed machining techniques
- To earn knowledge on various types of rapid prototyping techniques
- To learn about the role of computer aided engineering, Industry 4.0 and IOT in manufacturing,

UNIT I	**CNC MACHINING**	**9**
Numerical Control (NC) machine tools – CNC types, constructional details, special features, part programming fundamentals CNC – manual part programming – micromachining – wafer machining.		
UNIT II	**NON TRADITIONAL MACHINING PROCESSES**	**9**
Introduction to unconventional machining processes – Working Principle – Material removal mechanism - Parametric analysis and applications of processes such as ultrasonic machining, Abrasive jet machining, Electrochemical machining, Electro discharge machining, Electron beam machining, Laser beam machining processes - process parameters, tool wear, tool life and Machinability.		
UNIT III	**HIGH-SPEED MACHINING**	**9**
High-Speed machining centers, high-speed spindles, spindle sped, feed rate, cutting velocity, surface finish, selection of process parameters, ultra-high-speed machining centers, hard machining.		
UNIT IV	**RAPID PROTOTYPING**	**9**
Introduction to rapid Prototyping (RP), Need of RP -Rapid Manufacturing Process Optimization: factors influencing accuracy. Classification of different RP techniques based on raw materials, layering technique (2D or 3D) and energy sources-Laminated object manufacturing, Solid ground curing, Repetitive masking and deposition, Selective laser melting and Selective laser sintering		
UNIT V	**CAE & SMART MANUFACTURING**	**9**
Need for CAE in manufacturing, simulation of molten metal flow, inspections of casting, analysis of forging & welding processes using CAE Techniques, Introduction to Industry 4.0 and IOT in Manufacturing Industry.		
	TOTAL: 45 PERIODS	

OUTCOMES:

Upon the completion of this course the students will be able to

- Describe about the various types of CNC machines and part programming techniques
- Explain the working principle and material removal mechanism of various types of non traditional machining processes
- Summarize the process of high speed machining
- Distinguish between various types of rapid prototyping techniques
- Explain the application of computer aided engineering, Industry 4.0 and IOT in manufacturing

TEXTBOOKS:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007.
2. Paul DeGarmo E, Black J T and Ronald A Kohjer, "Materials and Processes in Manufacturing, John Wiley India, 2011.

REFERENCES:

1. Mikell P Grover "Principles of Modern Manufacturing (SI Version)" John Wiley & Sons, 2014.
2. Kaushish J P, "Manufacturing Processes", Prentice Hall India, 2013.
3. Kapil Gupta, J.Paulo Davim, "High Speed Machining", Academic Press,2020.
4. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998.
5. Rapid Prototyping and Engineering Applications, Frank W. Liou, CRC Press
6. Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 1984
7. Philip F Ostwald and Jairo Munoz, "Manufacturing Processes and Systems" John Wiley India, New Delhi, 2013.
8. Benny Raphael and Ian Alan Smith, Fundamentals of Computer Aided Engineering", Wiley-Blackwell, 2003.
9. Apurba Kumar Roy, Divya Zindani, and J. Paulo Davim, Industry 4.0: Developments Towards the Fourth Industrial Revolution, Springer, 2019.

ME1402	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I	STRESS, STRAIN AND DEFORMATION OF SOLIDS	9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes.

UNIT II	TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM	9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III	TORSION	9

Torsion formulation stresses and deformation in circular and hollows shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

UNIT IV	DEFLECTION OF BEAMS	9
Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.		
UNIT V	**THIN CYLINDERS, SPHERES AND THICK CYLINDERS**	**9**
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.		

	TOTAL:	**45**	**PERIODS**

OUTCOMES:

Students will be able to

- Understand the Concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- Understand the Distribution of load on beams and stress distribution due to shearing force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures.

TEXTBOOKS:

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016

REFERENCES:

1. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
2. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
3. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.
4. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009

ME1403	THERMAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To learn the working and performance of Internal combustion engines.
- To apply the thermodynamic concepts in Steam nozzles and Steam Turbines
- To understand the working principle and performance of air Compressors

- To study the concepts of Refrigeration and Air conditioning systems
  (Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

UNIT I	**GAS POWER CYCLES**	**9**

Air standard efficiency and mean effective pressure calculation for Otto, Diesel, Dual and Brayton cycles, Comparison of air standard cycles.

UNIT II	**INTERNAL COMBUSTION ENGINES**	**9**

Classification – Components and their function. Valve timing diagram and port timing diagram – actual p-V diagram of four stroke and two stroke engines. Carburettor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System – Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems.

UNIT III	**STEAM NOZZLES AND TURBINES**	**9**

Impulse and Reaction principles, Flow of steam through nozzles, effect of friction, critical pressure ratio, supersaturated flow, compounding, velocity diagram for simple and multi-stage turbines, speed regulations – Governors.

UNIT IV	**AIR COMPRESSOR**	**9**

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency derivation, Multistage air compressor and inter cooling –work of multistage air compressor, working of rotary compressor.

UNIT V	**REFRIGERATION AND AIR CONDITIONING**	**9**

Refrigerants and its properties - Vapour compression refrigeration cycle- super heat, sub cooling –
Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide – water systems (Description only) and Thermoelectric refrigeration . Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations.

	TOTAL:	**45**	**PERIODS**

OUTCOMES:

Upon completion of this course, the students will be able

- to apply the thermodynamic concepts in different gas power cycles
- to explain the functioning, components, auxiliaries and performance parameters of I.C.Engines
- to explain the flow and solve problems in steam nozzles and steam turbines
- to solve problems in single stage and multistage air compressors
- to solve problems using refrigerant table / charts and psychrometric charts

TEXTBOOKS:

1. Rajput. R. K., "Thermal Engineering" Laxmi Publication ,10th edition.
2. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", "Dhanpat Rai & sons , 2019

REFERENCES:

1. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007
2. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 2008
3. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill 2007
4. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2006
5. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.

ME1404	Mechanics of Machine-I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system /machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains in motion transmission and in machine components.
- To understand the friction concepts in machine elements.

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATIC ANALYSIS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV	**GEARS AND GEAR TRAINS**	**9**

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V	**FRICTION IN MACHINE ELEMENTS**	**9**

Friction drives – Friction during upward motion and downward motion – Friction in screw threads – Bearings – classification and application – lubrication – types – Friction clutches.

	TOTAL:	**45**	**PERIODS**

OUTCOMES:

Upon completion of this course, the students can able to

- Discuss the basics of mechanism
- Calculate velocity and acceleration of simple mechanisms
- Develop cam profiles
- Solve problems on gears and gear trains
- Examine friction in machine elements.

TEXTBOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
5. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
6. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
8. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.
9. Khurmi, R.S., "Theory of Machines",14th Edition, S Chand Publications, 2005
10. Sadhu Sigh : Theory of Machines, "Kinematics of Machine", Third Edition, Pearson Education, 2012.

EE1408	**MICROPROCESSORS AND MICROCONTROLLER**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

• To study the architecture of 8085, 8086 and 8051

• To study the addressing modes and instruction set of 8085, 8086 and 8051

- To introduce the need and use of interrupt structure in 8085, 8086 and 8051.
- To develop skill in simple program writing for 8085, 8086, and 8051 applications.
- To introduce commonly used peripheral / interfacing ICs, Simple applications development with Programming 8085, 8086 & 8051

UNIT I	**8085 MICROPROCESSOR**	**9**
Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, interrupt, Assembly Language program, Application- Traffic Light Control		
UNIT II	**16- BIT MICROPROCESSOR.**	**9**
8086 Architecture, Signals, Instruction set, Addressing modes, Minimum and Maximum mode configuration, Assembler Directives, Interrupts, interrupt service routines, Application- DAC		
UNIT III	**INTERFACING BASICS AND ICS**	**9**
Study of Architecture and programming of ICs: 8255, 8259, 8251, 8279, 8254 and DMA controller, Interfacing – ADC and LED display		
UNIT IV	**MICROCONTROLLER**	**9**
Architecture of 8051 – Special Function Registers (SFRs) - Ports and Circuits - Instruction set - Addressing modes - Assembly language programming. Application-LCD		
UNIT V	**MICRO CONTROLLER PROGRAMMING & APPLICATIONS**	**9**
Programming 8051 Timers – Serial Port Programming – Interrupts Programming, Simple programming exercises- key board and display interface –Control of servo motor, stepper motor control- Application to automation systems.		

	TOTAL:	**45**	**PERIODS**

OUTCOMES:

- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to acquire knowledge in Addressing modes & instruction set of 8085, 8086 & 8051.
- Ability to understand the need & use of Interrupt structure of 8085, 8086 & 8051.
- Ability to understand the importance of Interfacing.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications

TEXT BOOKS:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Sixth edition, Penram International Publishing 2012.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Second Edition, Pearson education, 2011.

REFERENCES:

1. Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design, Second Edition, Prentice Hall of India, 2007.
2. Krishna Kant, ―Microprocessor and Microcontroller Architecture, programming and system Design using 8085, 8086, 8051 and 8096, PHI, 2007, Seventh Reprint, 2011.
3. Kenneth J. Ayala., ―The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, 2012.
4. A.K. Ray, K.M. Bhurchandi, ―Advanced Microprocessor and Peripherals‖, Second edition, Tata McGraw-Hill, 2010.
5. Barry B. Brey, ―The Intel Microprocessors Architecture, Programming and Interfacing‖, Pearson Education, 2007. Second impression 2010.
6. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
7. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.
8. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu, 2016
9. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu, 2016.
10. Mike Predko, "8051 Micro-controller", McGraw Hill, 2009
11. Programmable Logic Controller and Microcontrollers by Gurpreet Kaur and S.K.Sahdev ,Uneek Publications ,Jalandhar.

ME1405	STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	4	2

Objectives:

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

STRENGTH OF MATERIALS LABORATORY LIST OF EXPERIMENTS **30**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison

(i) Unhardened specimen

(ii) Quenched Specimen and

(iii) Quenched and tempered specimen.

11. Microscopic Examination of

(i) Hardened samples and

(ii) Hardened and tempered samples.

FLUID MECHANICS AND MACHINES LABORATORY	**30**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 60 PERIODS

Course Outcomes:

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

Upon completion of this course, the students will be able to:

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

ME1406	CAD & CNC LABORATORY	L	T	P	C
		0	0	4	2

Objectives:

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

1.3D GEOMETRIC MODELLING	30

LIST OF EXPERIMENTS:

1. Introduction of 3D Modelling software

Creation of 3D assembly model of following machine elements using 3D Modelling software

a. Plummer Block
b. Screw Jack
c. Lathe Tailstock
d. Universal Joint
e. Machine Vice
f. Stuffing box
g. Crosshead

h. Safety Valves
i. Non-return valves
j. Connecting rod
k. Piston
l. Crankshaft

* Students may also be trained in manual drawing of some of the above components

2. MANUAL PART PROGRAMMING	**30**

(i) Part Programming -CNC Machining Centre

a) Linear Cutting.

b) Circular cutting.

c) Cutter Radius

d) Compensation. d) Canned Cycle Operations.

(ii) Part Programming - CNC Turning Centre

a) Straight, Taper and Radius Turning.

b) Thread Cutting.

c) Rough and Finish Turning cycle.

d) Drilling and Tapping Cycle.

3. COMPUTER AIDED PART PROGRAMMING

e) CL Data and Post process generation using CAM packages.

Application of CAPP in Machining and Turning Centre.

	TOTAL PERIODS: 60

Course Outcomes:

- Draw 3D and Assembly drawing using CAD software
- Demonstrate manual part programming with G and M codes using CAM

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Qty
	HARDWARE	
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
	SOFTWARE	

7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	15 licenses
9.	Licensed operating system	Adequate
10.	Support for CAPP	Adequate